1882MNRAS..42..365P

MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. XLII. JUNE 9, 1882. No. 8.

E. J. STONE, Esq., M.A., F.R.S., President, in the Chair.

Franklen George Evans, Esq., Tynant House, near Cardiff, was balloted for and duly elected a Fellow of the Society.

The Meridian Photometer. By Professor Edward C. Pickering.

This instrument is designed for the photometric observation, on or near the meridian, of objects not fainter than stars of the tenth magnitude. A smaller instrument constructed upon the same general principles has been used during the past three years in comparing the brightness of all stars visible in this latitude to the naked eye. This work is now nearly completed. The new instrument will be largely used in determining the ratios of light corresponding to the scale of magnitudes employed in the construction, and in the recent revision, of the "Bonner Durchmusterung." For this purpose, measurements will be made of the light of the stars observed during this revision at each of two co-operating Observatories. These stars are situated near the borders of the zones into which the northern heavens were divided in order to distribute the work of determining the positions of the stars.

One of the annexed photographs * exhibits the whole of the new instrument; while the other represents, on a larger scale, the end of it farthest from the eyepiece. The two plane mirrors at this end of the photometer are connected with tubes placed horizontally east and west, and capable of revolution in the

---

* The photographs are in the library of the Society.

1882MNRAS..42..365P

plane of the meridian. The inclination of each mirror to the axis of its tube may also be varied. By means of connecting-rods and cords these movements of both kinds may be effected by the observer without leaving his place at the eyepiece, and also by an assistant stationed near the mirrors. One of the mirrors is ordinarily directed to λ *Ursæ Minoris*, with which the other stars are compared. The second mirror is connected with a longer tube, and projects beyond the first, so that it may be directed to any star within a few minutes of its meridian passage.

The light from the two mirrors is received respectively by two object-glasses of about four inches aperture and sixty inches focal length, placed within the instrument, and not shown in the photographs. Both the pencils of rays, before reaching the eyepiece, pass through a double-image prism, which can be reversed by the observer, in order to eliminate the error due to the partial polarisation of the light from the mirrors. The ordinary image received from one mirror and object-glass is compared with the extraordinary image from the other mirror and object-glass by means of a Nicol connected with the eyepiece. The double-image prism is then reversed, and the comparison repeated with the other pair of images, which are thus brought nearly to the place in the field previously occupied by the first pair. The pair not in use at the time is excluded from the field by an eye-stop.

A curtain, not shown in the photographs, protects the observer from the light of the gas-burners which illuminate the circles of the instrument. The assistant directs the mirror to the successive stars to be observed, and records the readings of the photometer circle near the eyepiece.

The two images compared in an observation with this instrument are placed under the same conditions, and it may therefore be hoped that the results obtained will be free from systematic error. Among causes likely to produce such error in photometric observations may be named those stated in the list below. Care has been taken to guard against them either in the construction of the instrument or in the methods of observation and of reduction which have been adopted.

1. Variation in light of the star or other object used as the standard of comparison.
2. Difference in the background of the respective images, due to twilight, moonlight, or other causes.
3. Varying atmospheric absorption, when the same object is observed at different altitudes.
4. Difference in reflecting-power of two mirrors.
5. Partial polarisation produced by reflection from mirrors.
6. Difference in the appearance of the images, due to unequal magnifying power, or to unlike sources of light.
7. Difference in the size or position of the two pencils of rays forming the images.

1882MNRAS..42..367D

8. Difference in the relative positions in the field of the two images in different observations.

Harvard College Observatory:
1882, *May* 8.

On Photographs of the Nebula in Orion, and of its Spectrum.
By Henry Draper, Esq., M.D.

(*Communicated by A. C. Ranyard, Esq.*)

At the meeting of the Royal Astronomical Society in January 1881 I presented a photograph of the nebula in *Orion*, which was taken on September 30, 1880, with my Clark telescope of 11 inches aperture and an exposure of 51 minutes. This was the first photograph ever taken of a nebula. It comprised the brightest parts in the neighbourhood of the trapezium, and showed the condensed masses well. In March 1881 a number of photographs of the nebula were taken, the best being on March 11 with an exposure of 104 minutes. By comparison with the former picture this made a marked advance, and minute stars down to the 14·7 magnitude of Pogson's scale were shown. An account of it was read before the French Academy of Sciences, and printed in the "Comptes Rendus," April 18, 1881.

On March 14, 1882, the negative was made from which the enlarged photolithographs herewith presented were produced. The instrument used was the Clark photographic refractor of 11 inches aperture, mounted on the equatoreal stand, and driven by the clock I had constructed. The exposure was from $7^h\ 8^m$ to $9^h\ 25^m$—that is, 137 minutes. Gelatino-bromide plates were employed. The night was clear, but cold and windy. The mean temperature was 27° F.; the wind NNW. and in gusts, the strongest pressure being 5 pounds per square foot, about 9 o'clock; the whole travel of the wind during the exposure was 35 miles. The variation in the force of the wind is one reason why the stars show some ellipticity under this magnifying power. The gusts of course displaced the telescope somewhat, though the mounting is firm and the clockwork strong.

In the photograph the larger stars are much over-exposed, the proper time to make a good picture of the trapezium being about 2 minutes. The twinkling of these stars is therefore recorded on the sensitive plate, and gives to them an excess of size. If a photograph should be taken on a steady night, the stars of the trapezium would be easily separated, and in the original negative of this picture, in a strong light, the separation can be seen. The variation in size of the stellar images gives an idea of the relative magnitude of the stars, though that estimate requires correction for the colour of the stars. It must be remembered that no one enlargement can do justice to the original negative: various exposures, various intensities of light,